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Should or could? Testing the use of autonomy-supportive language and the provision of choice in online computer-tailored alcohol reduction communication

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Abstract

Individuals can feel more motivated to change health behaviour when perceiving autonomy-support, as induced through non-pressuring message phrasing and the provision of choice: autonomy-supportive message framing. Additionally, controlling message phrasing – commands that do not provide choice – can thwart autonomy and lead to reactance, which is detrimental to the persuasiveness of health messages. Many health messages have not been formulated in an autonomy-supportive manner and therefore could arouse reactance, resulting in reduced intervention effectiveness. We aimed to test the effects of autonomy-supportive vs. controlling alcohol reduction message frames on individuals' perceived autonomy-support from these messages; and their reactance towards the message while considering the individual need for autonomy in the context of an online computer-tailored alcohol reduction intervention. A 2 (autonomy-supportive language vs. controlling language) × 2 (choice vs. no choice) between-subjects experiment ($N = 521$) was conducted using an online computer-tailored alcohol reduction intervention. Outcome measures were perceived autonomy-support and reactance and we investigated whether an individual's need for autonomy moderated the effect of autonomy-supportive and controlling message frames on those outcome variables. Multiple linear regression analyses showed that neither autonomy-supportive nor controlling message frames had significant effects on perceived autonomy-support or reactance, and there was no moderation from the need for autonomy. Overall, participants evaluated the intervention as positive and perceived high levels of autonomy-support, regardless of the message frame used. Future research needs to test whether the positive intervention evaluation is due to content tailoring, and whether more distinguishable manipulations of message frames could be effective.

Keywords

Message framing, autonomy-supportive, controlling, choice, perceived autonomy-support, need for autonomy, reactance

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Introduction

A reduction in alcohol consumption could mitigate or prevent health threats, such as cancer and liver cirrhosis.¹ Various online health interventions have been developed that can persuade individuals to reduce the amount of consumed alcohol at low intervention costs.² Online computer-tailored alcohol reduction interventions can offer individualised and personalised feedback to participants and have been shown to be effective in reducing alcohol consumption.³ A meta-analysis

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conducted by Lustria et al. showed, however, that effect sizes of tailored online health-communication interventions remain small.⁴ One explanation for this may be because, to date, these interventions have most often been tailored only in terms of their content,⁵ i.e. tailoring messages to an individual's self-reported current health behaviour and/or self-reported scores on known predictors of the desired health behaviour (change), but other types of tailoring, such as message-frame tailoring have rarely been tested. Differences in personal preferences concerning how health-related information is presented have so far been largely ignored in these interventions. This implies that, even if an intervention provides relevant content only, it may remain unclear whether the intervention meets the respondent's preferences for a particular delivery mode and message frame.⁵ Thus, additional strategies that optimise the effect of online computer-tailored alcohol reduction interventions are needed, e.g. by exploring the influence of different messages. A body of evidence on human motivation has shown that individuals' motivation to change (health) behaviour can be significantly enhanced when they perceive that they can choose to perform a behaviour autonomously.⁶ Health-communication interventions can support individuals' sense of autonomy and thus enhance motivation to change behaviour by means of incorporating autonomy-supportive message frames.⁷⁻⁹ Autonomy-supportive message frames acknowledge the reader's feelings and minimise pressure on the reader to change (through the use of words, such as 'could' and 'would'), and often offer behavioural choice (e.g. 'Do you want to make a coping plan?').^{8,10,11} In interpersonal settings as well as in the context of text messages, autonomy-supportive message frames, as compared to either neutral text messages or a controlling interpersonal conversation style, have been found to lead to increased motivation to perform the advocated healthy behaviour.^{7,10-12} Contrastingly, in those contexts, controlling message frames are frequently found to lead to reactance, which is a motivational state of negative arousal expressed by anger and counterarguing in response to perceiving a threat to one's sense of autonomy.¹³ Controlling message frames are replete with imperatives (e.g. commands and orders using words like 'must' and 'should'), impose the advocated perspective on the message receiver and do not offer choice.^{9,11,14,15} In the context of alcohol reduction interventions this suggests that when a communication strategy uses a controlling message-frame, this arouses reactance and individuals may reject that message or even engage in a counter-advocated behaviour, such as binge drinking.¹⁵⁻¹⁷

Even though, to date, many persuasive alcohol-related health messages have been formulated in more controlling message frames, which could lead to

message rejection, to the best of our knowledge, no evidence exists that reports on the effects of autonomy-supportive vs. controlling message frames on perceived autonomy-support and reactance in the context of online alcohol reduction interventions.^{17,18}

Moreover, studies show that people differ substantially in personal characteristics, such as their need for autonomy (e.g. desire to experience choice and initiate own behaviour). Thus, the level of perceived autonomy-support or reactance arousal experienced might depend on a person's individual need for autonomy; someone who has a high need to be self-determining is expected to be more reactant when being controlled or (verbally) forced to reduce his or her alcohol consumption than someone with a lower need for autonomy.^{7,18,19}

Therefore, this experimental study aimed to test the effects of two autonomy-supportive message frames: autonomy-supportive vs. controlling language, and the provision of choice vs. no choice in the context of an online computer-tailored alcohol reduction intervention on individuals' perceived autonomy-support from these messages, and their reactance towards the message content, while considering the individual need for autonomy.

Theories of human motivation and reactance

Self-determination theory: An explanation of autonomy and fundamental human needs

Self-determination theory (SDT) is a prominent and frequently used theory that attempts to explain human motivation.^{20,21,22} In SDT, two types of behavioural regulation are distinguished, namely controlled and autonomous behavioural regulation.²³ Controlled behaviours are considered to be performed due to pressure from external factors, for instance, punishments or negative emotions such as guilt and therefore can lead to ill-being. Conversely, autonomous behaviours result from conscious decisions that are personally relevant, valued, and are important for sustainable behaviour change and well-being. In addition, autonomous-regulated behaviours are described as positive experiences that are inherently joyful, such as leisure time activities, and can be promoted by the satisfaction of three fundamental human needs: competence, relatedness, and autonomy.^{6,19,22-24} Satisfying the above-mentioned three fundamental needs can furthermore foster a transition from controlled towards autonomously regulated behaviours. The need for autonomy is based on the assumption that individuals have the desire to perceive freedom and to feel volitional in their actions, as in being able to independently decide when and how to reduce their alcohol consumption.^{23,24}

Many online computer-tailored alcohol reduction interventions, such as the intervention that provides the context for the current study, already satisfy the need for competence by providing suggestions for action and coping plans to manage (sustained) behaviour change, also in situations when it is difficult to refrain from alcohol consumption.^{3,4,25,26} In most online computer-tailored interventions that are based on socio-cognitive theories such as the I-Change model,²⁷ the need for competence is targeted in the form of feedback tailored to the respondents' self-efficacy.^{4,25,26,28} To illustrate, advice offered in the intervention used in the present study was tailored to participants' responses about their perceived difficulty in refraining from alcohol consumption in certain situations (e.g. when feeling down or sad) and offered tips to participants about what they could (or must, in the controlling language condition) do in such situations to distract themselves from drinking. Through such advice, the intervention aimed to enhance people's self-efficacy and thus satisfy their need for competence. Moreover, the need for relatedness is often targeted through the provision of normative feedback and the affirmation of feelings, such as offering information on what peers do and feel when they try to curb their alcohol consumption.^{11,29–32} Evidence for fulfilment of the need for autonomy in tailored health-communication interventions is, however, scarce.⁶ Hence, this study will investigate whether different message frame types can satisfy the need for autonomy in an online computer-tailored alcohol reduction intervention.

Autonomy-supportive language and the provision of choice

In health messages, the need for autonomy can be satisfied by means of message formulation or framing, that is, offering an 'autonomy-supportive' message frame.^{24,29,33,34} Autonomy-supportive message frames, as opposed to controlling message frames, are often operationalised as messages that use autonomy-supportive language, which minimises pressure through words such as 'would', 'could', and 'might', which encourage the receiver to accept responsibility, that take the perspective of the message recipient into account through reflective feedback, and that highlight personal choice and freedom by offering participants a behavioural choice (e.g. they could choose the situation(s) for which they wanted to make a plan).^{8–11,19}

Autonomy-supportive message frames in contexts such as physical activity, dietary behaviours and smoking cessation have already been tested and applied successfully in interpersonal settings and other offline health-communication.^{11,15,17} In Resnicow and colleagues' study, autonomy-supportive messages triggered

self-initiation. Moreover, the provision of choice for different alternatives to increase fruit and vegetable intake seemed to empower recipients, which led to higher fruit and vegetable consumption.⁹ These findings suggest a positive relationship between autonomy-supportive message frames and perceived autonomy-support. Furthermore, Kinnafick, Thogersen-Ntoumani and Duda found that autonomy-supportive text messages, which promoted physical activity (i.e. by communicating a meaningful rationale, enhancing perceptions of the value for physical activity and providing choice) led to higher levels of perceived autonomy-support.⁷ In sum, autonomy-supportive message framing has been shown to encourage individuals to find their own autonomous motivation to perform recommended behaviours, which may also apply to online messages. However, as far as we know, it has not yet been investigated which of the message-frame elements – autonomy-supportive message formulation or the provision of personal choice – reflects the effective ingredient that results in increased perceptions of autonomy-support in these messages.

Psychological reactance theory: The threat to autonomy

In contrast to SDT, which particularly describes the benefits of satisfying the need for autonomy for well-being and health, psychological reactance theory (PRT) developed by Brehm, focuses on the human responses that occur when the need for autonomy is threatened.¹³ According to PRT, reactance is a state of motivational arousal that leads to a subsequent action to restore the threatened autonomy.³⁵ Such a threat to autonomy can be induced through the use of controlling messages, that are conceptualised as directive, forceful messages containing commands, orders and norms (e.g. 'must', 'you have to', 'should'), and are often briefer compared with the propositions or indirect suggestions in autonomy-supportive messages.^{14,15,36}

In earlier studies, the persuasive alcohol reduction messages employed often led to a perceived threat to one's autonomy, therefore this approach may induce reactance, as many individuals perceive a great deal of autonomy when drinking alcohol.¹⁸ In his meta-analytic review about the conceptualisation of PRT, Rains reported that the framing of health messages influences the perception of threat to autonomy in the offline setting.¹⁷ Health messages perceived as a threat to autonomy led to message rejection, which could be detrimental for health campaigns.¹⁷ Such autonomy-threatening messages were explicit in the message's intention and replete with imperatives (i.e. 'must' and 'do') representing a controlling message-frame. Controlling message frames have been found to

produce reactant responses in different contexts, such as binge drinking and alcohol consumption, dental flossing, skin cancer, and smoking cessation.^{15,16,18,37,38} In sum, controlling (health) messages are likely to threaten to the need for autonomy and thus lead to unintended negative effects, such as message rejection.^{15,17,38–40} Such an unintended negative effect could be, for instance, performing a counter behaviour to the one advocated (e.g. continuing excessive alcohol consumption when drinking less alcohol is advocated).^{18,35,41}

Combined effects of autonomy-supportive message frames and offering choice

Most studies that investigated the effects of autonomy-supportive health messages included two message elements: the use of autonomy-supportive language and the provision of choice.^{7–9,42} Thus, we propose to first consider whether either message element independently results in higher levels of autonomy-support.

In addition, from the literature on multimedia communication, we know that a synergy effect can exist in situations when ‘the combined effect of multiple communication activities exceeds the sum of their individual effects’.⁴³ Therefore, we aim to explore whether the combination of offering choice and using autonomy-supportive language – two different message elements – leads to higher levels of perceived autonomy-support compared with the provision of choice and the use of autonomy-supportive language alone. Shen found that not providing choice in the controlling messages led to reactance arousal among participants compared with controlling messages that provided choice³⁸; when a person’s behavioural freedom is restricted, such as through reading a controlling message, this freedom is not only restored by autonomy-supportive language, but through the opportunity for personal choice.¹³ For individuals presented with a controlling message without such personal choice, behavioural freedom is not restored. They may thus perceive less freedom than persons presented with only one controlling message feature. Therefore, we will test whether the effect of both message-frame features, namely autonomy-supportive language and offering personal choice, reinforce each other.

The individual need for autonomy

SDT proposes that individuals with a high need for autonomy feel more supported in their autonomy when receiving autonomy-supportive message frames than individuals with a low need for autonomy.²² Resnicow et al. investigated this SDT statement by offering participants both autonomy-supportive and

controlling messages, which promoted fruit and vegetable intake.⁹ In this study, the need for autonomy moderated the message effects. Participants with a high need for autonomy who received autonomy-supportive nutrition messages had a significantly higher intake of fruit and vegetables compared with those individuals with a low need for autonomy and who received the same dietary information messages. In a second study, Resnicow et al. confirmed these findings.⁸ In this study about cancer screening, participants with a high need for autonomy reported higher screening rates when receiving autonomy-supportive messages than participants with a low need for autonomy. Thus, we assume that individuals with a high need for autonomy seem to perceive more autonomy-support compared with individuals that have a lower need for autonomy when receiving autonomy-supportive messages.

When the need for autonomy is thwarted, individuals tend to develop a fairly strong controlled orientation, or amotivation to perform a behaviour, which implies no enjoyment and diminished functioning.⁴⁴ Furthermore, in the context of virtual gaming, it was shown that when players’ autonomy-needs were not met, they became aggressive while playing, which is according to Dillard and Shen an antecedent of reactance arousal.^{16,45} Following this theorisation and the same reasoning described to support Hypothesis 4, we anticipate that the individual need for autonomy will moderate the degree of reactance arousal. Thus, individuals with a higher need for autonomy are expected to have a higher degree of reactance when their need for autonomy is thwarted through controlling alcohol reduction messages, than individuals with a lower need for autonomy.

Hence, we aim to test the following hypotheses:

H_{1a}: Online computer-tailored alcohol reduction messages that use autonomy-supportive language will lead to higher levels of perceived autonomy-support compared with messages that use controlling language.

H_{1b}: Online computer-tailored alcohol reduction messages that provide choice will lead to higher levels of perceived autonomy-support compared with messages that do not provide choice.

H_{2a}: Online computer-tailored alcohol reduction messages that use autonomy-supportive language will lead to lower levels of reactance compared with messages that use controlling language.

H_{2b}: Online computer-tailored alcohol reduction messages that provide choice will lead to lower levels of reactance compared with messages that do not provide choice.

H₃: The combination of autonomy-supportive language and providing choice in online computer-tailored alcohol reduction messages will lead to higher levels of

perceived autonomy-support (H_{3a}) and lower levels of reactance (H_{3b}) than the use of autonomy-supportive language or the provision of choice alone.

H_4 : The positive effect of autonomy-supportive message frames (vs. controlling message frames) on the perceived level of autonomy-support is stronger for individuals with a high need for autonomy than for individuals with a low need for autonomy in the context of an online computer-tailored alcohol reduction intervention.

H_5 : The negative effect of autonomy-supportive message frames (vs. controlling message frames) on reactance is stronger for individuals with a higher need for autonomy compared with individuals with a low need for autonomy.

Methods

Design and materials

A 2 (autonomy-supportive language vs. controlling language) \times 2 (offering choice vs. not offering choice) between-subjects experimental design was employed. Participants were randomly assigned to one of the four conditions, differing in message framing by a computer randomisation software device, which allocated approximately 25% of all respondents to each group. In terms of message content, the online alcohol reduction intervention was based on an existing Dutch online computer-tailored intervention, called *Drinktest* (<http://www.webcitation.org/6qPCE1hWS>), which was targeted at people who drink alcohol.³

The intervention

The intervention combined respondents' answers to an online assessment with computer-tailored and personalised feedback messages on alcohol consumption, intended to help explore the negative consequences of excessive drinking and to support participants in lowering their alcohol consumption. The intervention consisted of two parts: first, an online questionnaire where respondents reported on their demographical data, weekly alcohol consumption, binge-drinking behaviour, chronic diseases, and drinking and driving behaviour. Respondents also compared their own alcohol consumption with their perceptions of their peers' alcohol consumption and reported on their intention to lower their alcohol consumption. Subsequently, participants were provided with personalised and computer-tailored alcohol reduction advice, based on the answers provided in the assessment. The advice provided normative feedback about one's alcohol consumption and information on the alcohol consumption guidelines from the Dutch Ministry of Health. In the case of

heavy drinking (i.e. more than 20 units of alcohol per week) recommendations were provided to reduce alcohol consumption and to contact with a health professional. In the second part of the questionnaire, participants answered questions about situations in which they usually drink alcohol, their attitude towards alcohol consumption, and their self-efficacy in lowering the consumption of alcohol. Afterwards, respondents again received personalised and computer-tailored advice based on their answers to the questions in this second part of the assessment. All provided advice was manipulated in either autonomy-supportive language or controlling language, and the provision of choice or not.

Participants and procedure

We recruited 637 participants using an online ISO-certificated research panel, called PanelClix (<http://webcitation.org/6q9tGKh5Z>). An a priori power analysis showed that a sample size of minimum 492 was adequate to detect small effects and interaction effects (power level = .80, effect size $f = 0.15$). Participants' approximately 20-minute participation was rewarded by PanelClix with 150 PanelClix points, which equals circa 1.88 euro. Prior to their enrolment in the study, participants were informed that the current study aimed to improve the existing programme, MyAlcoholConsumption, and were asked to provide their online informed consent. Personal data were not accessible for other than the research team. All participants were guided through the intervention as described above. Additionally, following the intervention, respondents were asked to evaluate the intervention (including the alcohol reduction advice), and reported on their perceived autonomy-support, reactance, and need for autonomy.

Inclusion and exclusion criteria

Eligibility criteria for participation in the study were being 18 years or older. Because the *Drinktest* intervention was specifically developed for drinkers who were motivated to reduce their alcohol consumption within the next six months, participants for this study also had to be motivated to reduce their alcohol consumption within this time frame. Moreover, respondents who did not complete the survey entirely, did not engage with the intervention, or participated for too brief a period in the survey (i.e. had z scores >3 for participation time) were excluded from participation.

Pilot

We piloted the four versions of the online computer-tailored alcohol reduction intervention and the

subsequent assessment of our outcome measures (perceived autonomy-support and reactance) with four health-communication and alcohol reduction experts, and four Dutch adults (of different gender and socioeconomic status). Every condition was piloted with one Dutch adult and one alcohol reduction and health-communication expert. The pilot had two aims; first we investigated the clarity, length to complete and layout of the online assessment. Second, we tested the stimulus material, therefore, we asked whether the message frame received was perceived as autonomy-supportive or controlling (after participants had received a definition of these terms), and whether participants felt that the intervention provided choice or not. If any of the respondents judged these (or additional) aspects of the intervention as unclear, difficult to understand, too long or not having an appealing layout, then the research team discussed the feedback and after reaching consensus, changes in the intervention were made where appropriate. Furthermore, we decided to create a greater contrast between the conditions by also manipulating the message frames used in the instructions in the assessment of the intervention (since we wanted to keep the content of the intervention similar in all conditions, and to the original *Drinktest* intervention). Thus, we deemed the manipulations to be successful.

Experimental stimuli

Language. Except for the content provided as a result of the choices made by respondents in the choice condition, only the language of the intervention was manipulated while keeping the content of the alcohol reduction advice similar across conditions. In the *autonomy-supportive language* condition, message frames were manipulated by encouraging respondents to accept more responsibility for their own behaviour by taking the perspective of the message recipient into account through reflective feedback, by incorporating praise and using language that minimised pressure, such as ‘Great that you want to reduce your alcohol consumption. It would really be better for your body and condition if you would drink less alcohol’.^{8–11,19} In the *controlling language* condition, alcohol reduction messages were manipulated by frequently using directive and forceful sentences with many imperatives, commands, and orders (e.g. ‘You must drink less alcohol, so your body and condition will be better’). The controlling messages were often briefer than the autonomy-supportive messages.^{14,15,36} Furthermore, many of our controlling messages clearly stated the message source (e.g. ‘experts say’, ‘according to the Dutch guidelines’) and filling terms were avoided where possible (i.e. ‘luckily’, ‘congratulations’).

Choice. We operationalised the provision of choice similar to Shen, as a linguistic presentation of alternative behaviours that serve a similar prevention, preparation and/or coping purpose.³⁸ In the *choice* condition, participants saw three different preparatory plans (i.e. plans in preparation of their behaviour change) and seven coping plans to help them deal with difficult situations. Participants in the choice condition could then choose whether and how many plans they wanted to make. These preparatory and coping plans were supposed to be personally relevant and helpful for participants in reducing their alcohol consumption, as they were tailored to participants’ earlier responses. Participants in the *no choice* condition were provided with only one predefined coping plan, which was the same for every participant in the no choice condition. In addition, the plans participants in the no choice condition viewed were not specifically tailored to their earlier responses, but was one of the plans participants in the choice condition were also presented with.

Measures

Background variables. Background variables were assessed in the context of the *Drinktest* intervention, such as age, gender, living arrangements, educational level, intention to get pregnant (likewise for men: whether they intended to have a child with a partner), and presence of a chronic disease were assessed via single items. Further, alcohol-related behaviours were measured, e.g. the number of alcoholic beverages consumed during a typical week, binge-drinking behaviour, and drinking and driving behaviour. Intention to reduce one’s alcohol consumption was assessed with one item: asking participants within what time frame they planned to reduce their alcohol consumption: ‘I am not planning to reduce my alcohol consumption within the next half year’, ‘I am planning to reduce my alcohol consumption within the next 6 months’, ‘I am planning to reduce my alcohol consumption within the next month’, ‘I am already reducing my alcohol consumption’, and ‘I reduced my alcohol consumption 6 months ago’. We also asked respondents to estimate their own alcohol consumption compared with their peers, assessed on a five-point Likert scale (ranging from ‘More’ to ‘Less’).

Dependent variables. The primary outcome of this study was *perceived autonomy-support*, which was measured with the Virtual Care Climate Questionnaire (VCCQ).⁴⁶ The VCCQ consists of 15 items that can be answered on a seven-point Likert scale (where 1 = strongly agree and 7 = strongly disagree) and has been proven to be reasonably valid and highly reliable.⁴⁶ Participants were asked questions like ‘I feel

that the intervention has provided me with choices and options' and 'I feel that the intervention provided me with effective possibilities to reduce my alcohol consumption'. Finally, we computed one total mean score of the VCCQ items (Cronbach's $\alpha = .95$, $M = 3.63$, $SD = 0.73$).

Reactance was measured as in earlier studies by Rains and Turner, using a cognitive component (counterarguing) and an affective component (anger).³⁶ *Counterarguing* was assessed using the thought listing method, by asking an open-ended question; participants had 90 seconds to write down all of the thoughts they had while reading the alcohol reduction advice.⁴⁷ Then, comments were segmented into thought units (meaningful parts, consisting of just one word or a couple of words with a clear beginning and end) and then evaluated as positive, neutral or negative towards the alcohol reduction advice. Negative polarity scores reflected overall negative comments, whereas positive polarity scores reflected overall positive comments. *Anger* was assessed with a four-item scale used in earlier research in the context of alcohol reduction by Dillard and Shen, which had good reliability ($\alpha = .94$).¹⁶ We asked participants, 'While reading the alcohol advice I felt angry/irritated/annoyed/aggravated'. (where 1 = strongly disagree and 5 = strongly agree).¹⁶ The Dutch version of the questions showed good reliability in studies about advertisement, as well as in the present study (Cronbach's $\alpha = .84$, $M = 2.02$, $SD = 1.06$).^{48,49}

Moderator. *Need for autonomy* was measured with the Health Causality Orientations Scale (HCOS). The HCOS is a novel scale based on the General Causality Orientations Scale.⁵⁰ For this study, the HCOS was translated from English to Dutch. Participants received four different vignettes for which they had to indicate the likelihood of responding in four different ways (each reflecting a different type of orientation). For instance, one of the vignettes read: Imagine you would have to change your behaviour to get healthier. How likely would it be that you would: (1) motivate yourself (autonomous orientation), (2) ask family and friends to motivate you (controlled orientation peers), (3) ask an expert to motivate you (controlled orientation experts), or (4) wait to get motivated eventually (impersonal orientation), all measured on a five-point Likert scale ranging from 1 = very unlikely to 5 = very likely. In order to measure the need for autonomy we computed the mean score of the four responses reflecting an autonomous orientation, which resulted in a high Cronbach's alpha ($\alpha = .80$, $M = 4.15$, $SD = 0.75$).

Statistical analysis

All analyses were conducted using IBM SPSS (24.0) for Windows and analysis was done per-protocol. Chi-squared tests and analysis of variance (ANOVAs) were conducted with condition as independent variable and background variables as dependent variables to check for equal distribution and successful randomisation across the conditions. Additionally, for the regression analysis, interaction variables were created to test interaction effects between the need for autonomy, language, and choice on outcome variables (perceived autonomy-support and reactance). In total, three separate multiple regression analyses were conducted to test for main and interaction effects of the independent variables (language, choice, need for autonomy) on the dependent variables (perceived autonomy-support and reactance).

Results

Sample characteristics

A total of 637 participants assessed the online questionnaire and 521 (82%) of these participants fulfilled the inclusion criteria for this study. Participants could be excluded for multiple reasons: when they did not provide informed consent ($n = 34$), had no intention to reduce their alcohol consumption within the next six months ($n = 12$), and/or did not respond reliably to the questionnaire (i.e. respondents who gave contradictory responses to questions and/or had response times lower than five minutes, which was deemed too quick for processing the intervention and accompanying questions) ($n = 80$). Furthermore, we removed four respondents as their total weekly alcohol consumption was deemed unrealistic, i.e. the cases that were removed reported drinking 72–88 alcoholic beverages per week. The final sample consisted of 521 people. Of these 521 eligible respondents, the majority (60.3%) was male. Respondents had a mean age of 46.6 years ($SD = 16.1$), and 51.2% had a college or university degree and, on average, perceived high levels of autonomy regardless of their condition ($M = 4.15$; $SD = .75$). Table 1 provides the sample characteristics for this study.

Descriptive statistics and randomisation

Of all respondents, 131 (25.1%) were assigned to the autonomy-supportive language and having choice condition, 135 (25.9%) to the autonomy-supportive language and having no choice condition, 126 (24.2%) to controlling language and having choice, and 129 (24.8%) to the controlling language and no choice condition. The randomisation check revealed that there

Table 1. Characteristics of participants ($N = 521$).

	<i>n</i>	%
Gender		
Female	207	39.7
Male	314	60.3
Age		
<i>M</i> (SD)	46.6 (16.1)	
Educational level		
High	267	51.2
Middle	191	36.7
Low	49	9.4
Other/missing	14	2.7
Living arrangements		
With partner	209	40.1
With partner and child(ren)	145	27.8
With child(ren)	16	3.1
Alone	109	20.9
Other/missing	42	8.1
Existence of (chronic) disease	198	38
Weekly number of consumed alcoholic beverages		
<i>M</i> (SD)	14.2 (10.7)	
Intention to reduce alcohol consumption		
Within the next 6 months	164	31.5
Within the next month	119	22.8
Currently reducing	166	31.9
Reduced half a year ago	59	11.3
Binge drinking		
Once a month	133	25.5
2 to 3 times per month	72	13.8
Once per week	59	11.3

(continued)

Table 1. Continued

	<i>n</i>	%
More than once per week	51	9.8
Never	205	39.3
Other/missing	1	0.2
Intention to get pregnant		
Yes	34	6.5
No	280	53.7
Intention to get pregnant (women <50 years)	16	6.5
In the near future	16	6.5
Currently trying	6	1.2
Pregnant	3	0.6
None of the above	94	18

Note: Educational level was measured with one item asking participants what their highest education was (0 = none; 1 = low: primary school/basic vocational school; 2 = medium: secondary vocational school/high school degree; 3 = high: higher vocational school/college degree/university degree). The percentages from 'Intention to get pregnant' do not add up to 100%, as this question was automatically skipped for female respondents above 50 years of age. The percentage for 'Intention to reduce alcohol consumption' does not add up to 100% due to the exclusion of participants who had no intention to reduce their alcohol consumption. The percentage for 'Binge drinking' does not add up to 100% due to decimal rounding. SD = standard deviation.

were no significant differences between the conditions in terms of the background variables. Therefore, no background variables were included as covariates in subsequent analyses.

Main analysis

Effects of language, the provision of choice, and need for autonomy on perceived autonomy-support. The regression model with perceived autonomy-support as dependent variable and language, choice and need for autonomy, as well as their interactions, as independent variables was significant, $F(7, 513) = 21.55$, $p = .000$ and explained 22.7% of the variance in perceived autonomy-support based on variations made in the intervention's language, the provision of choice, individuals' need for autonomy, and their interaction.

Main effect. Hypothesis 1 predicted a positive effect of autonomy-supportive language use (vs. controlling language use; H_{1a}) and offering choice (vs. no choice; H_{1b})

on individuals' levels of perceived autonomy-support. Results showed that there was neither a significant main effect of autonomy-supportive language on perceived autonomy-support ($b^* = -.09$, $t = -.26$, $p = .799$), nor did individuals perceive higher levels of autonomy-support when they were offered choice ($b^* = .03$, $t = .09$, $p = .921$). Therefore, we reject Hypothesis 1 (see Table 2). Yet, the participants' mean value of perceived autonomy-support was on the higher end of the 7-point Likert scale ($M = 3.6$, $SD = .72$), regardless of the message frame they received (see Table 3).

Combined effect. In Hypothesis 3, we suggested that the combination of autonomy-supportive language and the

provision of choice would lead to higher levels of perceived autonomy-support compared with the use of autonomy-supportive language or the provision of choice alone.

Here too, the regression model showed that there was no significant interaction effect between autonomy-supportive language and the provision of choice when predicting the level of perceived autonomy-support ($b^* = .213$, $t = .55$, $p = .584$). This was not as expected and thus, we reject Hypothesis 3a.

Moderation. Hypothesis 4 predicted that the positive effect of autonomy-supportive message frames (vs. controlling message frames) on perceived autonomy-support would be stronger for individuals with a high need for autonomy than for individuals with a low need for autonomy. However, we did not find a significant interaction effect between the need for autonomy and either autonomy-supportive language use or the provision of choice on the outcome variable. Thus, our data did not confirm Hypothesis 4. Additionally, there was a significant positive main effect of the need for autonomy on perceived autonomy-support, which suggests that individuals with a higher need for autonomy perceive higher levels of autonomy-support. The results from the regression analysis can be found in Table 2.

Effects of controlling language, no provision of choice, and need for autonomy on reactance. Since we measured the concept of reactance with negative cognitive responses (i.e. counterarguing) and negative affect (i.e. anger), we report the following analysis for both variables separately.

Counterarguing. In Hypothesis 2 we expected that the use of autonomy-supportive language and offering choice would lead to lower levels of reactance. The

Table 2. Regression results to test hypotheses 1, 3a, and 4.

Dependent variable	Perceived autonomy-support b^*
Language	-.09
Choice	.03
HCOS	.49***
Language x Choice	.21
Language x HCOS	.09
Choice x HCOS	-.07
Language x Choice x HCOS	-.18
R^2	.23***

Note: b^* = standardised regression coefficient. HCOS = need for autonomy. # $p < .01$; R^2 = proportion of variance explained by model; *** $p < .001$.

Table 3. Overall means of outcome variables per experimental condition.

Dependent variable	Perceived autonomy-support M (SD)	Anger M (SD)	Counterarguing M (SD)
Autonomy-supportive language * choice	3.59 (.72)	1.95 (1.08)	.15 (.32)
Autonomy-supportive language * no choice	3.68 (.75)	1.96 (1.05)	.17 (.38)
Controlling language * choice	3.59 (.66)	2.12 (1.06)	.11 (.35)
Controlling language * no choice	3.66 (.75)	2.03 (1.02)	.09 (.31)
Overall M (SD)	3.63 (.72)	2.01 (1.05)	.13 (.34)

Note: M = mean; SD = standard deviation.

regression model with language, choice, and need for autonomy, and their interactions as independent variables was only marginally significant for counterarguing as dependent variable, $F_{\text{counterarguing}}(7,419) = 1.96$, $p = .059$. The regression model could only explain 3.2% of the variance in counterarguing, based on variations in the intervention's language, provision of choice, and individuals' need for autonomy.

Main and combined effects. There was no significant main effect of autonomy-supportive language on counterarguing against the alcohol reduction advice ($b^* = .37$, $t = 82$, $p = .411$) in comparison with controlling language (H_{2a}). Moreover, we did not detect a significant effect of the provision of choice on counterarguing (H_{2b} : $b^* = -.30$, $t = -.72$, $p = .473$), nor did their combination lead to lower levels of counterarguing (H_{3b} : $b^* = -.494$, $t = -.965$, $p = .335$). Thus, we reject hypotheses 2 and 3b for counterarguing.

Moderator. In Hypothesis 5, we expected that the negative effect of autonomy-supportive message frames (vs. controlling message frames) on reactance would be stronger for individuals with a higher need for autonomy compared with those with a lower need for autonomy. According to the counterarguing measure, a total of 6.6% of the participants counterargued the alcohol reduction advice. Furthermore, the results of the regression analysis, which are depicted in Table 4, showed no significant interaction effect between the need for autonomy and language, the need for autonomy and choice, or their three-way

interaction. Additionally, the need for autonomy had no significant main effect on counterarguing. Thus, we reject Hypothesis 5.

Anger. The regression model with language and choice, need for autonomy and their interactions as independent variables was highly significant for anger as dependent variable, $F_{\text{anger}}(7,513) = 7.49$, $p = .000$. Therefore, the regression model could predict the variance in anger, based on variations in the intervention's language, provision of choice, individuals' need for autonomy, and their interactions, and explained 9.3% of the variance in anger.

Main and combined effects. The analysis revealed that individuals did not have significantly lower levels of anger when autonomy-supportive language was used (H_{2a} : $b^* = -.13$, $t = -.36$, $p = .721$) nor were individuals significantly less angry when choice was provided (H_{2b} : $b^* = -.53$, $t = -1.54$, $p = .125$) compared with the use of controlling language and no provision of choice, respectively. Furthermore, the combination of autonomy-supportive language use and the provision of choice did not lead to significantly lower anger arousal than either of the two message elements alone (H_{3b} : $b^* = .235$, $t = .561$, $p = .575$). In accordance with the above results from counterarguing and anger as outcome measures, we reject hypotheses 2 and 3b.

Moderator. As can be seen in Table 4, individuals with a higher need for autonomy compared with those with a lower need for autonomy did not perceive significantly lower levels of anger when presented with autonomy-supportive message frames (vs. controlling message frames). The expected interaction effect between need for autonomy and language style on anger could not be confirmed. Yet, we found a significant negative main effect of the need for autonomy on anger, which implies that individuals with a high need for autonomy would generally perceive lower levels of anger. We also found a marginally significant interaction effect between the need for autonomy and the provision of choice on anger. In order to determine the cut-off point of this interaction effect, we used the Johnson–Neyman technique, called 'floodlight analysis' from the PROCESS macro for SPSS (Model 1; bootstrapping procedure: $n = 5000$).⁵¹ The floodlight analysis identifies the region of the moderator continuum at which the effect of the independent variable choice on the dependent variable (i.e. anger) transitioned from statistical insignificance to statistical significance. The cut-off value for statistical significance was 2.06, which implies a trend towards individuals with a relatively low need for autonomy perceiving

Table 4. Regression results to test hypotheses 3b and 5.

	Anger b^*	Counterarguing b^*
Language	-.53	.37
Choice	-.13	-.31
HCOS	-.38***	.02
Language x Choice	.24	-.49
Language x HCOS	.11	-.25
Choice x HCOS	.57 [#]	.35
Language x Choice x HCOS	-.30	.45
R^2	.09***	.03 [#]

Note. b^* = standardised regression coefficient. HCOS = need for autonomy. [#] $p < .01$; R^2 = proportion of variance explained by model; *** $p < .001$.

higher levels of anger compared with individuals with a higher need for autonomy, when not provided with choice. Based on these results, Hypothesis 5 is rejected.

Discussion

Main findings

This study aimed to explore the effects of autonomy-supportive vs. controlling message frames on perceived autonomy-support and reactance while considering individuals' different levels of need for autonomy as a possible moderator.

Contrary to our expectations, we did not find significant effects for the use of autonomy-supportive language and the provision of choice – nor their combination – on perceived autonomy-support (H_1 and H_{3a}). These findings do not match results of previous research on the effects of autonomy-supportive vs. controlling message frames, either in interpersonal settings or delivered as printed or mobile text messages.^{7,11,34} In these studies, receivers of autonomy-supportive message frames perceived significantly greater autonomy-support compared with individuals who received neutral message frames. One explanation could be that the online computer environment of our intervention may have led to not being able to reproduce findings from, for instance, interpersonal environments. For example, non-verbal cues in a face-to-face setting with a human healthcare provider who gives alcohol reduction advice could lead to a different perception of autonomy-support than such advice in an online computer intervention.⁵² Yet, Kinnaefick and colleagues indicated that participants were able to perceive significantly higher levels of autonomy-support via mobile text messages (compared with the control group who received neutral text messages), which is a comparable non-personal environment like the online environment in the present study.⁷ Furthermore, we considered this different type of environment by measuring perceived autonomy-support with a questionnaire especially developed for virtual environments: the VCCQ.⁴⁶ In addition, in a recent study with a similar scope, the provision of choice (vs. no choice) led to higher levels of perceived autonomy-support, more perceived relevance, and a higher overall evaluation of an online computer-tailored intervention aimed at increasing vegetable consumption. These recent findings suggest that in an online computer environment, autonomy-supportive message frames can also lead to higher levels of perceived autonomy-support than controlling message frames. We assume that the different types of (health) behaviours, namely (alcohol) reduction and promotion (of vegetable consumption)

behaviour could have led to the different findings between the vegetable consumption and alcohol reduction studies. Therefore, we recommend replication of this study with a greater range of reduction behaviours, in addition to alcohol reduction such as smoking cessation, to investigate whether the type of behaviour could explain our findings.

Moreover, as we found that participants had overall high levels of autonomy-support, regardless of the message frame used, we assume that this finding could be linked to the inclusion criteria of the present study. We only included people who intended to reduce their alcohol consumption. According to the meta-analysis by Hagger and Chatzisarantis, autonomy-supportive environments promote intention to change a health behaviour.⁵³ Thus, one could argue that the participants were predisposed to perceive higher levels of autonomy-support.

Next, we expected that alcohol reduction advice written in controlling language would have led to reactance. However, we did not find support for this hypothesis: neither had controlling language, not providing choice, nor their combination had an effect on reactance arousal (H_2 and H_{3b}). Overall, only a minority of participants in our study felt angry (10.1%) and/or counterargued (6.6%) the advice. However, it seems somehow striking that controlling message frames in our study did not lead to higher levels of reactance compared with previous research in the field that identified significant positive effects of controlling message frames on reactance.^{15,17,38,54} A possible explanation for this can be drawn from politeness theory, which states that reactance towards a persuasive message, such as was expected towards our controlling alcohol reduction advice, can be reduced due to message-based features.⁵⁵ Message-based features refer to, for example, the use of polite language, the inclusion of positive feedback, or the provision of information that claims common ground with message receiver's opinions. Such 'polite' messages could therefore reduce the level of threat to the message receiver's autonomy and reactance.^{55,56} In fact, our alcohol reduction advice, no matter the condition, contained positive feedback, provided information that if applicable confirmed the message receiver's opinion ('you estimated your alcohol consumption correctly'), and were written in polite language (controlling condition: 'It is likely that you feel alone [...]. Go and do something nice.'). As a consequence, messages in all experimental conditions could have been perceived as polite and may thus have resulted in less or no threat to autonomy. Furthermore, one could also assume that the message content impacts on whether a message is perceived as autonomy-supportive or arouses reactance and that the message frame alone barely affects an individual's

perception. However, a body of evidence about content tailoring, personalisation, and message framing has shown that those techniques seem to be effective in enhancing perceived personal relevance, creating positive attitudes towards the message, increasing intention to change behaviour, and behaviour.^{4,57,58} Although we did not specifically test whether framing could act as a prerequisite for content tailoring, this seems to be an important question for future research, which could be studied by adding a content-tailored control group to the study design.

Remarkably, we found that people with a higher need for autonomy in general perceived higher levels of autonomy-support and less reactance arousal than people with a lower need for autonomy. It might seem intuitively logical that individuals with a high need for autonomy perceive more autonomy-support vs. individuals with a low need for autonomy, because these individuals might generally be more satisfied with the intervention (environment) and thus could have lower levels of reactance arousal. In contrast, one could also argue the opposite: individuals with a high need for autonomy would have rather higher levels of reactance when presented with alcohol reduction advice, because they generally prefer making their own decisions. Dillard and Shen found that individuals high in reactance proneness, that is, being able to experience greater levels of reactivity, reported more reactance arousal while reading autonomy-threatening messages about dental flossing.¹⁶ Reactance proneness and the need for autonomy are distinguishable concepts that seem to counteract each other. For instance, a person who highly appreciates setting personal goals and having the freedom to decide how and when to reduce the number of beers consumed might experience more reactance arousal when put under external pressure to quit drinking beer immediately.

Further, because the need for autonomy did not moderate the effect of message frames on perceived autonomy-support or reactance, one might suggest that message-frame tailoring, such as on the need for autonomy, would not lead to enhanced intervention effectiveness. Yet, this is one of the first studies testing the moderating effect of the need for autonomy and thus, our findings should be interpreted with caution. Moreover, previous research found that effects of cancer screening newsletters in different message frames on screening rates were moderated by participants' communication preference, which was not measured with a validated scale.⁸ In sum, in order to draw a conclusion about whether tailoring on the need for autonomy in health studies might enhance intervention effectiveness, this study should be replicated.

Limitations

Our findings need to be considered in the light of some limitations. First, keeping in mind that participants did not perceive different levels of autonomy-support and reactance across the four conditions in the present study, we may assume that the autonomy-supportive and controlling message-frame manipulations did not differ enough. This idea is supported when further analysing the qualitative data provided in the counterarguing measure as, interestingly, only 6.6% of the comments represented negative thoughts towards the alcohol reduction advice – 30.2% represented positive thoughts, and 63.2% of comments were neutral or off-topic thoughts towards the advice. Keeping in mind that about 50% of all participants received controlling advice, but only 6.6% of the participants articulated negative thoughts towards the advice, it may be suggested that the manipulation was not successful. Furthermore, there is a possibility that participants were not processing the message (frames) carefully enough, as offering a lot of text and content might have inadvertently stimulated skimming behaviour. Checking the mean time of completing the intervention however showed that, on average, respondents took 19.41 minutes ($SD = 22.89$) to complete the alcohol reduction intervention. For future research, we therefore recommend applying more distinguishable manipulations (e.g. more controlling message frames, such as a more frequent use of imperatives and commands and a more obvious choice manipulation, such as by asking participants more often whether they would like to receive more or less information and more or fewer plans) of autonomy-supportive vs. controlling message frames in online computer-tailored health interventions, but also to use for instance eye tracking methods to capture respondents' attention for, as well as their likely processing of, the different message-frame features.⁵⁹

A second limitation of this study was that the need for autonomy was measured with four items from a novel scale currently being developed in this field of research – HCOS (unpublished), adapted from Ryan and Deci's original General Causality Orientations Scale; it is possible that this scale did not sufficiently grasp the need for autonomy.⁵⁰ However, the HCOS sub-scale had good internal reliability. We also measured the need for autonomy with the full HCOS (including items for controlled motivation and amotivation), but found the same results.

Third, an inclusion criterion for this study was that participants had the intention to reduce their alcohol consumption in the next six months. This was considered an appropriate inclusion criterion according to the original Drinktest intervention, since participants who

are not willing to change their behaviour may require more intense resources to reduce their alcohol consumption, such as personal counselling, which cannot be provided within online interventions.^{3,60} Thus, motivated individuals were assumed to benefit more from an online intervention than unmotivated ones.^{60,61} Because participants were already motivated and might have started with positive expectations about curbing their alcohol consumption, they also might have been more satisfied with an online intervention than less motivated individuals. This could explain why, on average, lower levels of anger were found and only a minority of participants counterargued the alcohol reduction advice.

Conclusion

To conclude, our findings suggest that autonomy-supportive and controlling message frames did not produce significant effects on perceived autonomy-support and reactance, thus, we recommend future research to use more distinguishable message manipulations of autonomy-supportive and controlling message frames to induce greater effects on perceived autonomy-support and reactance. As the intervention was evaluated positively by participants, our findings point to the compelling need to replicate this study with content-tailored control groups to further investigate whether the positive intervention evaluation could have been due to content tailoring, regardless the message frame used. Additional research in both similar health behaviours, such as alcohol reduction and smoking cessation, and promotion behaviours, for instance healthy dietary intake is needed to investigate whether different types of health behaviour influence perceived autonomy-support and reactance in online interventions. Finally, further evidence is needed to confirm whether the need for autonomy moderates message-frame effects.

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